Gard. Men. Zool. Soc. ii. p. 207, cum fig. — *Plectropterus gambensis*, Steph. in Shaw, Zool. xii. pt. 2, p. 7, pl. 36; Hartl. Orn. West-Afr. (partim); Eyton, Monogr. Anat. p. 79; Sclater, P.Z.S. 1859, p. 131, pl. 152. fig. 2.

Sp. diagn.—Minor: *protuberantia sincipitali maris parva: lateribus colli in utroque sexu plumosis.*

Hab. In Africa Occidentali, accidentaliter in Europa Meridionali.

Mus. Brit.

2. Plectropterus rüppellii.

Cygnus gambensis, Rüpp. Orn. Misc. p. 12, fig. 1.—*P. gambensis*, Denham and Clapp. Travels, App. p. 204; Hartl. Orn. West-Afr. p. 246 (partim); Sclater, P.Z.S. 1859, p. 131, pl. 152. f. 1.

Sp. diagn.—Major: *protuberantia sincipitali maris maxima: area rhombea ad colli latera nuda, carneo-rubra.*

Hab. In Africa Orientali et Centrali, in Dongola et lacu Tchad.

Mus. Brit.

The second species of *Plectropterus*, given by Stephens (*P. melanonotus*, Shaw, Zool. xii. pt. 2, p. 8) and also met with by Denham and Clapperton (App. to Travels, p. 204), is *Sarcidiornis africana*, Eyton (Monogr. Anatidæ, p. 103).

January 24th, 1860.

John Gould, Esq., V.P., in the Chair.

The following papers were read :—

1. A Monograph of the Genus Epomophorus, with the Description of a New Species. By Robert F. Tomes.

(Mammalia, Pl. LXXV.)

In the Proceedings of the Zoological Society for 1835, Mr. Bennett gave a short description of a Frugivorous Bat from Gambia, under the name of *Pteropus epomophorus*, at the same time suggesting that the characters appeared sufficiently diverse from those of the ordinary *Pteropi* to warrant generic separation. Under these circumstances, Mr. Bennett thought the specific name, *epomophorus*, would not be inappropriate as a generic appellation. A further account was given by the same naturalist in the Transactions of the Society, where the specific name *whitei* was substituted; and the species is now usually mentioned as *Epomophorus whitei*.

C H Ford

W West imp

EPOMOPHORUS FRANCQUETI

During the same year, but previous to the communication by Mr. Bennett, Mr. Ogilby had described a *Pteropus* from Gambia under the name of *P. macrocephalus*. In the volume of Lardner's 'Cabinet Cyclopædia' devoted to the natural history and classification of Quadrupeds, Mr. Swainson described a *Pteropus*, and gave a figure of the head, from Western Africa, for which the name of *P. megacephalus* was proposed. The volume bears date 1835.

All these species are now found to be identical, *Epomophorus whitei* being the male, and the other two the female of the same species. As far as can be ascertained, Mr. Ogilby's name has the priority, and should therefore be made use of; but, before going further into the synonymy of the species, I will give the results of some examinations made with a view to the determination of the generic peculiarities of this and other closely affined species.

The backward position of the wings, and the length of the face, have been already mentioned by the first describers, and the excessive development of the upper lips has been noticed by M. Temminck in another species called by him *Pachysoma labiatum*; but there are some other peculiarities (having reference to this last character) not hitherto sufficiently insisted on.

The original specimens described by Mr. Bennett and Mr. Ogilby having passed into my hands, together with a number of other specimens of this and two other species referable to the same group, I have been able to examine them with exactness, and more especially to compare their crania with those of other fruit-eating Bats. The result has been a thorough conviction not only of their generic distinction, but that the genus is more removed from the ordinary *Pteropi* than is *Pachysoma*, or even perhaps *Macroglossus*.

For the better understanding of the affinities of the present genus, I deem it advisable first to institute an inquiry into the relation of the genera *Pteropus* and *Pachysoma* to each other, and afterwards to compare with them the various species of *Epomophori*.

M. Geoffroy St.-Hilaire, in his 'Leçons sur les Mammifères,' has separated from the genus *Pteropus* several species which depart from the more typical forms of that genus in being possessed of a tail, in having the muzzle shorter and thicker, and the lower jaw provided with only five molar teeth, that of *Pteropus* proper having six.

In the 'Annales des Sciences Naturelles' for 1828*, M. Isid. Geoffroy, after adverting to the establishment of this genus by his father, observes, "Le museau des *Pachysomes* est gros, et leur boîte cérébrale est très-volumineuse et sphéroïdale; mais entre ces deux parties existe un rétrécissement très-sensible, quoique beaucoup moins prononcé que chez les grandes Roussettes. Un grand espace existe ainsi entre les parois du crâne et les arcades zygomatiques, qui sont d'ailleurs beaucoup plus écartées que chez les Roussettes; et comme l'étendue de cet espace est en rapport avec le volume du masséter et du crotaphyte, nous voyons s'accroître de beaucoup chez les *Pachysomes* la force des muscles élévateurs de la mâchoire

* This communication bears date Oct. 1828, whilst the published volume of the 'Leçons' is dated 1829.

inférieure ; fait d'autant plus remarquable que cette mâchoire elle-même est courte, et n'a d'étendue que dans la portion qui donne insertion aux muscles, c'est-à-dire sa portion postérieure et son aphyse coronoïde."

The peculiarities here pointed out in the cranium of those species which have a tail should not be regarded as characters necessarily associated with that appendage, but as incidental to the smaller species of the group; the tail also in this particular group being restricted to the smaller species. "The smaller species in any natural family of Mammalia," says Professor Owen, "resemble the fœtus of the larger species in the general proportional size of the brain and eyes." This well-known law will, if followed out, explain pretty fully the nature of the differences in the crania of the larger and smaller *Pteropi*. The tail might probably have been either absent or present in both, without interfering with the results. Had M. Isid. Geoffroy instituted an examination of the cranium of one of the common species of *Pteropi* at several periods of its growth, he would at once have seen that previously to attaining the full size it had the cerebral cavity of manifestly greater relative capacity than afterwards; and coincidently with this a greater thickness of the facial part is observable, but more especially a greater breadth between the orbits. My observations were first made from the examination of a series of skulls of *Pteropus poliocephalus*; but I afterwards, to be quite satisfied that I was not noting a mere specific peculiarity, examined those of *P. edwardsii*, *P. edulis*, *P. rubricollis*, *P. hypomelanus* and *P. dasymallus*, and met with the same results. In the Pachysomes the same law also obtains, the skulls of the smaller species, such as *P. duvaucellii* which furnished M. Isid. Geoffroy with materials, having a relatively much greater cerebral region than those of the larger ones, such as *P. stramineum* and *P. ægyptiacum*. These latter, although possessed of tails, do not differ at all materially in the general conformation of their crania from the true *Pteropi*.

The same holds good with the crania of the *Epomophori*, but in a much greater degree. They vary from an exceedingly elongated form, as in *E. macrocephalus*, which has the facial part half its entire length, to a form which is remarkable for its shortness and convexity, and in which the facial part is scarcely more than one-fourth of its total length; these skulls at the same time exhibiting no departure from the more important details of structure. For instance, all have the same shape and degree of development of the lower jaw, similar teeth, both in number and form, and similar modification of the form of the supra-orbital process of the frontal bone; but those species in which the facial portion of the cranium is long, are the larger ones; those in which it is short and thick, the smaller ones.

Genus Epomophorus, Bennett, 1835.

Pachysoma, Temminck.

General form of the body rather robust. The wings, ample in relation to the bulk of the body, are broad and rounded at the ends.

The breadth is in some measure occasioned by the fingers being more expanded than is usual in other *Pteropodidæ*, especially by the space between the index and longest finger being wider than is usual. The thumb, which is long, has its basal half enclosed in the antibrachial membrane, which further assists in giving greater breadth to the wing. The wings, as noticed by Mr. Bennett and Mr. Ogilby, are situated farther back than is usual in the allied genera, and the antibrachial membrane, maintaining its full breadth from the side of the body to the carpus, contributes also towards giving the base of the wings a backward appearance, whilst in *Pteropus* this membrane narrows as it approaches the wrist, and does not, therefore, bring that part so far forward in relation to the base as in *Epomophorus* *. Another peculiarity in the organs of flight, remarkable as occurring in the Frugivorous Bats, but usual in the Insectivorous ones, is that their membranes spring at once from the sides of the body, instead of being attached along the sides of the vertebral column, more or less near to it in the different genera.

The form of the head varies very greatly in the different species of *Epomophori*, but the lips seem constantly to present that extraordinary amount of development which induced M. Temminck to apply to one of the species the specific name of *labiatus*. In so far as can be gathered from the inspection of these parts in skinned specimens, rendered soft for the purpose of examination, they appear to be quite simple—the lips of an ordinary *Pteropus* very much enlarged. There is nothing about the form of the nostrils which does not occur in the genera *Pteropus* and *Pachysoma*. The ears are rather small, simple, and ovoid.

The tail is rudimentary, scarcely more than a mere tubercle, and the interfemoral membrane margins the legs and coccyx as in *Pteropus*. The feet moderate, with the wing-membranes extending to the base of the toes, and attached to the upper surface of the second † one, as in *Pteropus* and *Pachysoma*.

With the comparatively greater development of the cutaneous system in *Epomophorus* is associated what may probably be regarded as a higher degree of development in the membranes themselves. Instead of the thick and leathery wings of the true *Pteropi*, they have membranes more or less translucent, and strongly marked with lines and papillæ, as in some of the Insectivorous genera. As the

* I regret that I have not been able to examine specimens otherwise preserved than in skin, or mounted. In these it appears to me that the humerus is of great length in relation to the fore arm, and this, unless the wing be perfectly expanded, must bring the elbow in a more backward position than if it were shorter. When we consider that the wing-bones necessarily in all cases spring from precisely the same part of the body, it must be evident that the more backward appearance in one case than in another is due either to some modification in the form of the wings themselves, or to the mere elongation of the neck of the animal. In the excellent figure given by Dr. Peters of *E. crypturus*, the length of the humerus and peculiar form of the wings are well shown.

† The one next to the *outer* one in the ordinary position of the foot of a Bat, but in reality the one next the *inner* one of other Mammalia.

larger species of *Epomophori* approximate in size to the smaller species of *Pteropus*, a comparison of these parts may be easily made.

The fur is short and of a cottony texture, with but little difference in quality on the different parts of the body, that of the under parts being somewhat shorter and rather less soft than that of the upper. It is everywhere unicoloured from root to tip, and there are constantly two tufts of white fur at the base of the two margins of the ears, but not differing in quality from that of the other parts of the body. In some of the species the males are furnished with very remarkable tufts of long stiff hairs on the shoulders, usually of a yellowish or white colour.

In an examination of the crania of the several species of this genus some great peculiarities appear. If we take the skull of one of the most remarkable of them, *E. macrocephalus*, we shall be struck with the excessive length of the facial, and the extreme smallness of the cranial portions; but on examining the skulls of the other species these proportions are seen gradually to alter, until in the smallest one, *E. schoensis* (*Pteropus schoensis*, Rüpp.), they are actually reversed, whilst some other characters, more easily overlooked, will be found to be constant in all the species.

Mr. Ogilby observes that the upper jaw has but three molars (on each side), and the lower five, and that the first one in the upper jaw and the second one in the lower have so much the form of canines as to give the mouth the appearance of having four pairs of these teeth. On comparing the teeth with those of the ordinary *Pteropi*, the same prominent molars are easily recognisable in the latter, but, being less conical, they have not the canine-like appearance which Mr. Ogilby observed in *Epomophorus*.

I will now proceed to notice some real differences which exist in the dentition of the genera *Pteropus*, *Pachysoma*, and *Epomophorus*. The skull of the common *Pteropus edwardsii* will supply all that is necessary for the first of these genera.

Upper jaw.—On examining the upper jaw, the incisors and canines may be passed by as presenting nothing which is not common to the three genera. The next tooth following the canine is extremely small, and can be seen only in crania which bear evidences of immaturity; at a more advanced age it is lost. To this succeeds a large and prominent pre-molar, having somewhat the relative proportions, and holding the same position with regard to the following three molars, which the *carnassier* tooth does in the insectivorous genera. Then come the true molars, three in number, also as in the insectivorous species, but the hinder one so much reduced in size and abnormal in shape, as to be merely rudimentary. In *Pachysoma* the dentition of the upper jaw differs from that of *Pteropus* in the absence of the hinder or rudimentary molar, and in having the first or small pre-molar retained to a later period, perhaps permanently. In *Epomophorus*, on the contrary, it is wanting; but in one instance I can clearly trace a depression in the alveolus, which probably indicates the former presence of a tooth there, which, as in *Pteropus*, may be lost with age. Then comes the prominent tooth or *carnassier*,

like that of *Pteropus* and of *Pachysoma*, but rather more pointed, less angular, and having anteriorly a very canine-like appearance. The remaining teeth—restricted to two in number—are small and feebly developed, the hinder one the smaller of the two. The third or hinder one, which in *Pteropus* was but rudimentary, is here quite lost, and the one nearest to it has undergone a degradation in development corresponding with that of the one in *Pteropus*, which is absent.

Lower jaw.—In *Pteropus* we find in the lower jaw, omitting the incisors and canines, first a small and tubercular pre-molar, not often absent; second, a large and prominent pre-molar, shaped like the long one in the upper jaw; and third, another similar in form to the last, but less prominent. Three other teeth complete the number, and they gradually decrease in size to the hinder one, which is a mere tubercle with a flattened crown. The fourth tooth from the canine or the third one counting from behind, occupies the place proper for the *carnassier*, but that tooth exhibits no peculiarities of form. Reverting for comparison to *Pachysoma*, as before, the difference which we find in the dentition of the lower jaw from that of *Pteropus* assists in the numeration of the different kinds of teeth of the latter. We find the small anomalous pre-molar followed at a considerable interval in some of the species by a prominent and rather pointed tooth. Then comes another interval, followed by three teeth, the first of which is considerably longer than the other two, and more pointed It has somewhat of the carnassial form, and is placed in the position proper for that tooth in relation to the two molars, whilst the tooth in front of it is here separated from those on either side like an ordinary pre-molar. The same dentition obtains in the lower jaw of *Epomophorus*, with this difference, that both molars are greatly reduced in size, being scarcely more than rudimentary.

From this it would appear that the Frugivorous Bats form an exception to the law which regulates the variation in the dentition of the Insectivorous ones, in which the true molars are liable to but slight variations in number or form, and in which the pre-molars suffer considerable modifications, not merely in the several genera, but even in the different species in the same genus. It is possible that the pre-molars may be in reality absent in this group, and their places taken by modified true molars, and by this means the proper *number* of the latter preserved. But this is rendered improbable, if not actually disproved, by the fact that the absence in one genus (*Pachysoma*) of the third true molar is predicted by its rudimentary condition in another (*Pteropus*), in which the proper number of true molars certainly exists. And this partial development of the molar series may be traced yet further in those genera which have lost the third molar, and in which the second molar has assumed in some measure the abnormal form and size of the third or missing one.

Besides the abridgment in number, and imperfect development of the molar teeth, the cranium of *Epomophorus* exhibits certain other peculiarities worthy of note. It is altogether a fragile structure, the upper maxillary bones in some of the species being so thin and

translucent that it is easy to see through their outer walls the form of the enclosed roots of the molar teeth ; and if held up against a lamp, the light will readily pass through both their outer and palatal portions. A similar lightness of structure obtains everywhere. The supra-orbital process of the frontal bone is small and directed more backwards than in *Pteropus*; so small in *E. schoensis* that it can scarcely be called a process *. The zygoma throws up no process to meet that of the frontal, so that in those species where the process of the latter bone is wanting the orbit is continuous with the temporal fossa, as in the generality of the Insectivorous genera, and as in other orders of Mammalia. Viewing the skull from beneath, it exhibits some other peculiarities. The auditory bullæ are, as in *Pachysoma*, more developed than in *Pteropus*, and the hinder margin of the palate is but very slightly curved, but has the appearance of a transverse ridge more or less raised from the level of the palate.

The lower jaw, besides being exceedingly thin everywhere, has its alveolar or anterior part extremely narrow in a vertical direction. Its posterior part is remarkable for the almost entire absence of ridges or other roughness for the attachment of muscles, and for the form of the angular portion. The lower margin of each ramus is very nearly straight from the lower part of the *symphysis menti* to the angle, which forms a simple curve up to the condyle. In the different species this curve is of different degrees of sharpness, most pronounced in *E. franqueti*, n. s., and least so in *E. schoensis*. In none of them does the angular region project so far back as the condyle. The coronoid process is elevated about as much above the condyle as the latter is above the lower margin of the ramus. Its anterior boundary runs obliquely forward with an easy descent to the posterior molar, constituting, in fact, more than half of the entire length of the upper margin of the jaw.

I will now offer a few suggestions relative to the probable nature of the food of the *Epomophorus*. In the *Desmodus*, where there is absolutely no mastication required, the true molars are wholly wanting ; and the pre-molars, although not reduced to the minimum number, are diminished to a very rudimentary condition. It happens that in this genus the zoologist has the opportunity, rarely met with in this order, of comparing singularity of structure with habits known to be of a most extraordinary nature, so extraordinary as to be unique among Mammalia, and, as far as I know, among the whole of the Vertebrata; and he can at once discern the exact adaptation of the one to the other. But without information concerning the habits, would he by a mere inspection of the teeth have inferred them ? I think not. He would indeed infer, from the absence of molars, that the creature did not eat food requiring mastication ; and the form and character of the incisors and canines would clearly point to some food requiring to be cut or torn ; but it would scarcely occur to him that they were intended to puncture the skin of such animals as horses, and enable the creature by a suctorial operation to feed on

* Being produced in a backward direction, it may be said to be adherent to the body of the bone, rather than to be wholly absent.

their blood. And if, in the absence of evidence of its sanguivorous habits, the investigator had compared the dentition of *Desmodus* with that of any of the *Felidæ*, in which the molars are reduced in number, and the premolars and canines greatly developed for the purpose of tearing flesh, he would very possibly have supposed that there was some analogy between the two, and that the one was a modification of the other, each being fitted to the insectivorous or carnivorous type of structure, on which their respective orders are supposed to be based. We are in pretty much the same position with regard to the habits and food of the *Epomophorus*, and can at best only indicate the kind of diet which would be within the management of its teeth. Although there is not, as in *Desmodus*, a complete absence of molar teeth, yet they are so imperfect that we are forced to conclude that they are not fitted for the purpose of mastication, in the ordinary sense of the word; but we cannot make any use of our subsequent knowledge of the habits of *Desmodus* as any argument in the case of *Epomophorus*, because the general structure of the latter proclaims that it strictly pertains to the *Phytophagous* type, whilst that of the former is as strictly *Zoophagous*. Moreover, the habits of *Desmodus* being understood, and the several peculiarities in its structure found in perfect unison with them, it becomes extremely easy to see that it is only in the one respect of having merely rudimentary molars that *Epomophorus* bears any resemblance to *Desmodus*. Instead of large and trenchant incisors, suitable to serve the purpose of lancets, these teeth in *Epomophorus* are small and blunt; and the premolars, instead of being rudimentary, are, on the contrary, some of them so developed as to have equal prominence with the canines. But, notwithstanding this, we are still precluded from supposing that the creature could subsist on food requiring mastication, properly speaking; and the question is, what is the kind of food for which the dentition of *Epomophorus* is specially adapted?

If, in speculating on the uses of the peculiar dentition of *Desmodus*, we happened to make further examination of the parts connected with it, we should be able to decide that while the teeth might perform the office of lancets, the lips were modelled to the office of a cupping-glass, and that the whole constituted an apparatus admirably adapted to the sanguivorous habits attributed to the creature.

The *Epomophorus* is furnished with lips quite as extraordinary as those of the *Desmodus*. Although simple in form, they are of such enormous size as to hang down on each side of the face, almost an inch in some of the species; so large are they, that the mouth may be sewn up, and the jaws yet move to the full extent that their construction seems to warrant; and this, as it appears to me, affords some index as to the nature of the food. If for the food of the ordinary *Pteropi* we were to substitute some fruit of an exceedingly succulent nature, which would require but a trifling pressure to yield its juices, less strong molars would be needed, and consequently jaws of much less strength for their implantation, whilst the muscles required to work the jaws would be equally reduced in volume. All this we find in *Epomophorus*, and much more, contributing to strengthen

the suggestion. The voluminous lips would do good service during the squeezing operation, by preventing the escape of the juices, and very possibly the prominent rim across the back part of the palate might assist in constricting the mouth posteriorly, until a sufficient amount of fluid was collected to be swallowed, the more solid parts being rejected. The only suggestion I can make concerning the long and canine-like premolars is, that they may assist in gathering the fruit; but it should be remembered that the *Pteropi*, proper, have these teeth considerably developed, and therefore their prominence in *Epomophorus* must not be dwelt upon too strongly.

Dr. Andrew Smith says of *Pteropus leachii* that it repairs to Cape Town and its vicinity when the grapes are ripening, from which we are led to suppose that this fruit constitutes at that time their food. The *Epomophori* would be peculiarly fitted for such a *régime* as this, but we have at present no positive evidence that the grape is actually their food.

1. Epomophorus macrocephalus, Ogilby, sp.

Pteropus macrocephalus, Ogilb. Proc. Zool. Soc. iii. p. 101, July 1835; Wagn. Supp. Schreb. Säugeth. i. p. 367, 1840; Schinz, Synop. Mamm. i. p. 135, 1844.

Pt. epomophorus, Bennett, Proc. Zool. Soc. iii. p. 149, Oct. 1835; Wagn. Supp. Schreb. i. p. 367, 1840.

Pt. megacephalus, Swains. Nat. Hist. & Class. Quad. p. 92, 1835.

Epomophorus whitei, Bennett, Trans. Zool. Soc. v. 2. p. 38. pl. 6, Oct. 1835; Gray, Mag. Zool. Bot. ii. p. 504, 1838; Cat. Mamm. Brit. Mus. p. 38, 1843.

Pachysoma whitei et *P. macrocephala*, Temm. Esquiss. Zool. Côte Guiné, pp. 65 et 70, 1853.

I regret that I am unable to continue the specific name first associated with the generic one now made use of, but that given to the female of the species by Mr. Ogilby has unquestionably the priority, and must therefore be adopted. Of the names given by Mr. Ogilby and Mr. Swainson it is impossible to say which has the precedence; I have therefore chosen that which appears most appropriate.

Of all the species this one appears to typify most strikingly the genus *Epomophorus*. The head is very long, or rather the face, the distance from the eye to the nose being fully twice that of the distance from the eye to the ear. The nostrils are somewhat tubular, and a deep notch passes vertically between them, dividing the upper lip in half. As far as can be gathered from dried specimens, the lips attain in this species their full development, being perfectly capable, when softened, of distention to fully three times the extent of those of *Pteropus rubricollis*, a species of nearly similar size. The ears are small, ovoid, and narrowed at the tip, and, with the exception of two tufts of white hair, naked; these tufts are of fine short hair, and are placed at their two borders, quite at the root.

The antibrachial membrane is broader than in the other species, being as much as 8 or 9 lines at the elbow, and nearly as much where

it encloses the thumb. The interfemoral membrane margins the coccyx and legs, and is at the *os calcis* not more than 2 lines wide, at the coccyx the same, but at the knee as much as 5 lines wide.

All the face is covered with very short fine hair, with the exception of the muzzle, chin, and edges of the lips, which are naked. On the upper lip, towards the end of the nose, are a few scattered longish bristle-like hairs. The fur of the back extends on to the fore-arm for half its length, on to the hinder limbs for nearly the whole of their length, and on the membranes of the flanks for the breadth of half an inch. Nearly the whole of the interfemoral membrane has its upper surface hairy, the exception being at the *os calcis*. Beneath, the fore-arm membranes of the flanks and legs are similarly hairy, but more sparingly so, especially those of the latter.

Both above and beneath, nearly all that part of the wing-membranes which is between the last finger and the body is studded with rows of glandular dots, each bearing a little bundle of short hairs, most regular on its upper surface. All the other parts of the membrane are semi-opaque, and rather distinctly veined.

The fur of all parts of the body is short and soft, above longer and thicker than beneath; it is unicolour, and of a lightish cinnamon-brown, with an ill-defined oval patch on the abdomen of a cream colour. At the base of the ears are two little patches of soft white fur, just on their margins; and on the shoulder is the remarkable tuft of long white hairs which was first noticed by Mr. Bennett, and at that time regarded as peculiar to the species.

In the following table of dimensions, No. 1 refers to the type specimen of *E. whitei*, and No. 2 to the type specimen of *E. macrocephalus*.

	1.		2.	
	″	‴	″	‴
Length of the head and body	7	0	6	3
——— of the head	2	0	2	2
——— from the eye to the end of the nose	1	3	1	2
——— from the eye to the ear	0	5	0	$4\frac{3}{4}$
——— of the ears	0	8	0	8
Breadth of the ear	0	$5\frac{1}{2}$	0	$5\frac{1}{2}$
Length of the fore-arm	3	3	3	3
——— of the longest finger	6	0	5	8
——— of the fourth finger	4	7	4	4
——— of the thumb	1	6	1	$4\frac{1}{2}$
——— of the tibia	1	$4\frac{1}{2}$	1	$3\frac{1}{2}$
——— of the foot and claws	0	11	0	11
Expanse of wings	22	5	21	6*

* The spread of the wings is never a very satisfactory dimension in the *Cheiroptera*, for in such species as those constituting the present genus, in which the wings are broad and the fingers much curved, it is obvious that the real expanse of the wings is not given by following their curvature. On the other hand, if the measure taken be a straight line between the tips of the open wings, that line must necessarily vary in length with the degree to which they are opened—

Some peculiarities are noticeable in the cranium of this species, which, if not confined to it, are certainly not extended to all the others, and therefore cannot be mentioned as strictly generic. The palate in this genus, as has already been stated, is remarkable for the prominence of its hinder margin; this appears to be properly a generic character, but it is the present species which possesses it in the greatest degree, and with it a great curvature of the back part of the palate from side to side also, giving that part of the mouth a pretty complete dome-shape*. It is further characterized by the presence of very widely separated transverse ridges. If the mouths of any of those species of *Pteropi* be examined which are affine to the common *Pt. edwardsii*, they will be found to have ten or a dozen transverse palatal ridges; and in a fresh specimen of *Pachysoma stramineum*, a species more affine to *Epomophorus*, I have counted as many as nine; but in *E. macrocephalus* there are not more than six, and, if the great length of this part of the skull be borne in mind, it will be readily seen that they are far apart. But the deficiency in number is compensated for by their great thickness and prominence. The first is straight, and placed just behind the incisive foramen, and has a central projection; the second is also straight, but instead of a projection has a central notch, and is situate between the first pair of premolars; the third is strongly curved forwards, and is a simple entire ridge extended between the first pair of true molars; the fourth is considerably removed from the third, is equally curved and projecting, and has a more or less flattened surface; the fifth is of very peculiar form, being lozenge-shaped, with a central pit, and placed across the palate between the anterior roots of the zygomatic arches; the sixth and last is straight and transverse, but little raised, and is notched in the centre. Immediately behind this last one comes the deep dome-shaped hollow already noticed.

2. Epomophorus gambianus, Ogilby, sp.

Pteropus gambianus, Ogilby, Proc. Zool. Soc. pt. 3. p. 100, 1835; Wagn. Supp. Schrub. Säugth. i. p. 366, 1840; Schinz, Synop. Mamm. i. p. 135, 1844.

Epomophorus gambianus, Gray, Mag. Zool. Bot. ii. 504, 1838.

Epomophorus crypturus, Peters, Natur. Reise Mossam. Säugth. p. 26. t. v. u. xiii. 1852.

Pachysoma gambianus, Temm. Esquiss. Zool. p. 69, 1853.

This species differs considerably in appearance from the last in consequence of its much shorter head. The muzzle is in fact scarcely more produced than that of the ordinary *Pteropi*, and the eye

vary, in fact, with the fancy of the preserver. On the whole, therefore, it appears desirable to adopt the first of these methods. The actual expanse of the open wings of these specimens is not more than 17 or 18 inches. Mr. Bennett gives 12 inches as the expanse of the specimen which has furnished the dimensions in Column 1, which, as M. Temminck justly observes, is certainly an error.

* This peculiar form of the palate has most probably reference to the nature of the food.

scarcely more distant from the nose than from the ear. It resembles in this respect the well-known *Pachysoma stramineum*. In the form of the ears, lips, nostrils, and indeed of all other parts *taken in detail*, this species is so much like the last that it will be only necessary to mention a few trifling differences, and then proceed to give the more important ones of dimensions. The fur in its general character and quality is similar to that of the last species, but it is a little more strongly tinged with cinnamon, and rather less spread on to the membranes. There is the same obscure patch of whitish colour on the abdomen, and the ears are similarly furnished with tufts of white fur at the bases of their two margins, but the conspicuous shoulder tufts of *E. macrocephalus* are here very fully developed. They consist of a very slight warty excrescence clothed with fur, which differs from that which surrounds it only in being of a dirty-white colour. The membranes are a little more translucent, and somewhat paler in colour, than those of *E. macrocephalus*.

The teeth vary but little from those of *E. macrocephalus*, but the cranium itself has the facial part much shorter, and it is further remarkable for the slight extension of the supra-orbital process*. Unfortunately, in all the crania I have seen, the hinder margin of the palate has been destroyed in the process of preservation, so that I am able to notice only such of the transverse palatal ridges as are not posterior to the molar range. These are more simple in form than in the last species, but are equally prominent, and placed in relation to the teeth just as in that species.

The following dimensions are those of three specimens which formerly formed part of the Museum of the Zoological Society :—

	1.		2.		3.	
	″	‴	″	‴	″	‴
Length of the head and body ..	5	9	6	0	5	9
——— of the tail	0	2	0	1½	0	1½
——— of the head	1	10½	2	0	1	11
——— from eye to snout	0	11	1	0	1	1
——— from ear to eye	0	6	0	5½	0	4½
——— of the ears	0	9	0	9	0	9
Breadth of the ears	0	6	0	6	0	6
Length of the fore-arm	3	1½	3	2½	3	0
——— of the longest finger ..	5	9	6	0	5	10
——— of the fourth finger....	4	4	4	5	4	5
——— of the thumb	1	3	1	3	1	4
——— of the tibia	1	4	1	4		
——— of the foot and claws ..	0	10	0	10½	0	10½
Expanse of wings, following the phalanges.....	22	3	22	8	21	0

Hab. Gambia, Mozambique (*Peters*).

* For these details I refer the reader to the excellent figures of the cranium of this species given by Dr. Peters under the name of *E. crypturus*.

3. Epomophorus franqueti, n. sp. (Pl. LXXV.)

If the species in the present monograph took rank according as they are more or less typical in form, the present one should appear as second, the *E. labiatus* probably as third, followed by *E. gambianus*, and the list should be completed by the smallest and least typical species—*E. schoënsis*. But the first and most typical species is succeeded by the one which was described at very nearly the same time, as being much better known than those which were to follow.

The present one is much the largest species, attaining an expanse of more than 2 feet, and has the same singular tufts of hair on the shoulders as are recorded of the first species in the list—*E. macrocephalus*, but much more developed than in that species, and of a pale yellow colour. The only known specimen was forwarded to the French National Collection by Dr. Franquet of the French Imperial Navy, and from it I have, by the kind permission of M. Geoffroy St. Hilaire, taken the description which follows, and have had a carefully executed drawing made by M. Oudart, from which the illustrations accompanying the present paper have been copied. Its country is the same as that of the Gorilla.

The head is not nearly so long and narrow relatively as that of *E. macrocephalus*, but more nearly resembles that of *E. gambianus*. The ears, as in the other species of the genus, are of medium size, oval, and a little narrowed towards the tips; they are furnished with small tufts of fine white hair at the base of their inner and outer margins, like those of all the other species here described. The lips, as far as can be ascertained from the inspection of a mounted specimen, are large, although perhaps not quite equal to those of some of the other species. The interfemoral membrane is rather more ample than is usual in the genus.

The fur extends considerably on to the membranes, above and below, as in *E. macrocephalus*, and it is similarly unicolour, and possesses the same soft cottony texture. That of all the upper parts is of a cinnamon-brown colour, brighter and deeper than in the other species; the under parts similar, but the patch of whitish on the abdomen, which is faint as in the others, here takes the form of a clearly-defined oval space of pure white, as much as $2\frac{1}{2}$ inches long.

The shoulder tufts are very much developed, and differ somewhat from those of *E. macrocephalus*. They occupy a space on the shoulder of as much as $1\frac{1}{2}$ inch in length, in a descending direction; the lower half of this space consists of fur, which is of the same length and texture as that of the surrounding parts, but is of a buffy-yellow colour; whilst the upper part, constituting the real shoulder tuft, is composed of long yellow hairs, which spring outwards, and then curve downwards, partially hiding the short yellow hair already mentioned. All this yellow fur, both long and short, has a clear and well-defined outline. All the membranes are of a darkish cinnamon-brown.

The cranium is much less elongated than in either of the preceding species, and in its general proportions bears some resemblance to that

of *Pachysoma stramineum*, especially in the expansion of the zygomatic arches; but the teeth are of precisely similar number and relative proportion with each other, as in *E. macrocephalus*, although they are generally stouter than in that species. The lower jaw exhibits most unequivocally the peculiarities mentioned in detailing the generic characters. The dimensions of the cranium will be given with those of some of the other species, so as to afford a more direct means of comparison.

	″	‴
Length of the head and body	7	3
——— of the head	2	8
——— of the ears.....	0	10
——— of the fore-arm	3	9
——— of the longest finger.....	7	3
——— of the fourth finger	5	6
——— of the tibia	1	6
——— of the foot and claws	0	11
Expanse of wings, about	30	0

Hab. Gaboon.

4. Epomophorus labiatus, Temm., sp.

Pteropus labiatus, Temm. Mon. ii. p. 83. pl. 39, 1835–1841; Wagn. Supp. Schreb. Säugeth. i. p. 356, 1840; Less. Nouv. Tab. Règ. Anim. p. 13, 1842; Schinz, Synop. Mamm. i. p. 128, 1844.
Pachysoma labiatus, Temm. Esquiss. Zool. p. 68, 1853.
Epomophorus whitei, Gray, Cat. Mamm. Brit. Mus. p. 38, 1843.

Of this species, which has been considered by some zoologists as identical with the *E. macrocephalus*, I can only quote the words of M. Temminck, since I have not been able to take a description of it. Judging from the little that could be learned from an inspection of specimens without removing them from the case, I feel satisfied that the species is distinct; and, in order to make this monograph as complete as possible, I borrow the following description from M. Temminck's 'Monograph':—

Ears long and pointed; interfemoral membrane hidden in the fur, which covers a great part of the membrane; the lips large enough to hang several lines below the lower margin of the jaw, and entirely hide the line of the mouth laterally, as in some of the dog kind; the fur of the upper parts covering also in some measure the humeral region, and that part of the membrane near the flanks.

The fur cottony on all parts of the body, especially on the back; more sleek on the under parts. That which extends on to the membrane, and that on the top of the head, short and rough, and of a reddish-isabelle colour, more reddish towards the back. The two margins of the ears with white fur at their bases. Side of the neck reddish-brown, with two shoulder tufts of ample size, and composed of long white hairs which radiate from the centre of a glandular prominence; breast, humeral region, flanks, and region of the coc-

cyx pale rufous; middle of the belly covered with short hair, smooth, and dirty white.

The female, M. Temminck says, does not differ very greatly from the male, excepting in wanting the shoulder tufts, and in not having the great development of lips. From this it would seem that the latter peculiarity is sexual, which appears highly improbable if we admit that the greatly developed lips have a determinate function to perform, which could scarcely differ much in the two sexes. Moreover it is further rendered improbable by the facts that in the other species of the genus the peculiarity exists equally in both male and female.

Total length (English)	4″	4‴ or 5
Fore-arm.....	2	6
Expanse of wings	16	0

Hab. Abyssinia.

My note of the species made in the Leyden Museum is as follows:—"Much smaller than *E. macrocephalus*, and with the face relatively much shorter; shoulder tufts as in that species; size about that of *Pachysoma amplexicaudatum*."

5. Epomophorus schoënsis, Rüpp., sp.

Pteropus schoënsis, Rüpp. Mus. Senck. iii. p. 131, 1842; Schinz, Synop. Mamm. i. p. 129, 1844.

Dr. Rüppell observes of this species, that he had some doubts whether it might not be the young of the *Pteropus whitei* of Bennett, the incisor teeth of one of the specimens bearing indications of immaturity, but that some disparities in the proportions induced him to regard it as distinct.

At the dispersion of the Museum of the Zoological Society, two specimens of a small species of Frugivorous Bat, labelled "Gambia," fell into my hands, which I had no difficulty in identifying with the species described by Dr. Rüppell under the above name. Afterwards I met with another specimen in the Paris Museum which had been received from Gaboon with the specimen of *E. franqueti* already described. These examples have furnished the materials for the following description.

It is a miniature of *E. gambianus*, being the smallest of the *Pteropodidæ*, save the *Kiodote*, and has a shorter and more rounded head and shorter muzzle. These parts are somewhat similar to the same parts in *Pachysoma brevicaudatum*, and indeed the two species hold precisely the same position in their respective genera. *E. schoënsis* bears pretty closely the same relationship to *E. franqueti* as *P. brevicaudatum* does to *P. stramineum* and *P. ægyptiacum*.

As in those already described, this species has the two ear-tufts; the ears too are themselves so similarly proportioned as to need no particular description. The fur, like that of *E. gambianus*, extends on to the membranes, and in a perfectly similar manner, and in texture and colour agrees so well with that of that species as to re-

quire no further mention, except to notice the total absence of the whitish patch on the under parts, where the fur is of a uniform greyish-brown colour. With the exception of this difference, *E. schoënsis* might, as far as external appearance is concerned, be fairly described by stating it to be a pigmy *E. gambianus*.

The cranium requires special mention. It is short, and has the cerebral region rounded and devoid of crests or ridges, and instead of being, as in the more typical forms, shorter than the facial portion of the skull, it is longer, that part in front of the orbit not being more than half the length of that which is behind it. But while its general outline is less typical of the form of cranium which characterizes the genus, the parts taken in detail are not less typical. Thus the small development of the supra-orbital process, taken as a characteristic feature of the genus, is more remarkable in this species than in any other. It may be said to be directed backwards, and adherent, so that only an extremely small point is free. The space between the orbits is much wider in relation to the size of the skull than in the larger species. The palate, instead of having transverse ridges and furrows, is smooth, with a slight prominence behind the canines, of a hastate form, with the point directed backwards; behind this is a shallow depression of similar form, with its point extending almost to the hind margin of the bony palate. On each side of this point, and just within the raised rim which bounds the palate, are two ovoid smooth hollows.

The following are the dimensions of the two specimens from Gambia:—

	″	‴	″	‴
Length of the head and body	3	5	2	11
——— of the head	1	3	1	2
——— from nose to eye	0	6	0	5½
——— from ear to eye	0	4	0	3
——— of the ear	0	6	0	6
——— of the fore-arm	2	1	1	11
——— of the longest finger	3	9	3	3
——— of the fourth finger	2	9	2	6
——— of the thumb	0	10	0	8
——— of the tibia	0	10	0	9½
——— of the foot and claws	0	8	0	7
Expanse of wings, following the phalanges	14	0	12	6

Hab. Abyssinia, Gambia, Gaboon.

The following table will show the difference in size and proportion of parts of the crania of the species described in this Monograph, with the exception of *E. labiatus*:—

	E. macrocephalus.	*E. franqueti.*	*E. gambianus.*	*E. schoensis.*
	in. lines.	in. lines.	in. lines	in. lines.
Length from the extremity of the nasal bones to the occipital crest	.....	1 11	.....	1 0
Length from extremity of nasal bones to the front of orbit	1 0	0 9	0 10	0 $3\frac{3}{8}$
Length from extremity of nasal bones to the supra-orbital foramen	1 4	.....	1 1	0 $5\frac{7}{8}$
Length of the nasal bones	0 11	.....	0 9	0 3
Length of the zygomatic arches, taken from the ant-orbital foramen to the hinder margin of the condyloid fossa	1 0	0 10	0 10	0 $5\frac{3}{8}$
Breadth across the zygomatic arches...	1 0	1 2	0 11	0 $7\frac{1}{4}$
Breadth taken between the points of the supra-orbital processes.....	0 $9\frac{1}{2}$	0 7	0 7	0 $4\frac{1}{2}$
Length of the bony palate	1 5	.....	.....	0 $5\frac{1}{3}$
Length from the point of the canine to the posterior molar.....	0 $9\frac{3}{4}$	0 $8\frac{1}{4}$	0 8	0 4
Breadth between the two posterior molars	0 5	.....	0 $4\frac{1}{2}$	0 3
Breadth between the points of the canines.....	0 $3\frac{3}{4}$	.....	0 $3\frac{1}{2}$	0 2
Entire length of the lower maxilla ...	1 $11\frac{3}{4}$	1 7	1 7	0 $9\frac{1}{2}$
Height at the coronoid	0 $9\frac{1}{4}$	0 $7\frac{1}{4}$	0 7	0 3
Length from point of canine to posterior molar	0 $10\frac{1}{2}$	0 9	0 9	0 $4\frac{1}{4}$

2. Description of a New Species of Opossum, obtained by Mr. Fraser in Ecuador. By Robert F. Tomes.

(Mammalia, Pl. LXXVI.)

Didelphys waterhousii, n. s.

Fur rather long, soft, and of a cotton-like texture; general colour dark brownish-grey, tipped with rufous on the sides; under parts brownish-buff, with a stripe of yellowish-white along the centre of the throat and breast. A black mark through the eye, to near the end of the nose.

Muffle of a broadly ovoid form, more deep than wide, the oval figure truncated at the bottom, where the upper lip constitutes its base; notch of the upper lip, occasioned by the mesial groove of the muffle, deep; on either side of it, in the edge of the lip, a double cleft. A horizontal depression passing through the centre of the muffle, serves, with the vertical groove, to divide it into four divisions or quarters, of which the two upper ones have a somewhat discoid form, and project laterally over the nostrils, partially hiding them. The two lower ones are marked, each with two oblique shallow depressions, passing from near the centre of the muffle to its outer margins, near the base.

Ears broadly ovoid, hairy on their hinder surface, at the base only, and of a dark brown colour, tinged with yellow at the auditory opening. Feet of a pale fleshy-brown colour, suffused with exceedingly fine short hairs, scarcely visible to the naked eye, but becoming